

PRISSMA Project Plateforme de Recherche et d'Investissement pour la Sûreté et la Sécurité de la Mobilité Autonome 04/2021 - 04/2024

[L8.11] OPERATIONAL DESIGN DOMAIN

Main authors: Université Gustave Eiffel: Abdelmename Hedhli STRMTG: Pierre Jouve

Reviewers: CEA: Morayo Adedjouma CEREMA: Paul Guillemard Spherea: Cédric Gava Transpolis: Elodie Chateauroux Université Gustave Eiffel: Amira Chouchane UTAC: Rafael de Sousa Fernandes

Keywords: Automated Driving Systems (ADS), Operational Design Domain (ODD), Operational Domain (OD), Taxonomy

Abstract.

This document proposes a taxonomy dedicated to the ODD (Operational Design Domain) of an automated driving system. This taxonomy is organized in a tree structure with 3 levels, and a metric is also proposed for each attribute. In addition, the proposed taxonomy creates link between the specification of the ODD and the description of the OD (Operational Domain) on the one hand, and the description of the contexts of traffic scenarios.

Résumé.

Ce document propose une taxonomie de description de l'ODD (Operational Design Domain) d'un système de conduite automatisé. Cette taxonomie est organisée en arborescence à 3 niveaux, et une métrique est également proposée pour chaque descripteur. En complément, la taxonomie proposée permet de faire le lien entre la spécification de l'ODD et la description de l'OD (Operational Domain) d'une part, et la description des contextes des scénarios de circulation.

Version	Date	Auteurs	Relecteurs	Note
V1	21/10/22	A. Hedhli (UGE)		
		P.Jouve (STRMTG)		

Table des matières

1 2	Intro MET	oduction HODOLOGY	5 5
	2.1 2.2	Taxonomy Reading template	5 6
3	Desc	cription of the proposed taxonomy	7
	3.1 3.2	Deliverable structure Taxonomy – Level 1 / 2 - Tree Structure	7 9
4	desc	ription of the attributes of the taxonomy	. 10
	4.1	Introduction	. 10
	4.2	Description of the different levels of the taxonomy:	. 10
	4.3	Different uses of L3 components	. 11
5	The	me 1 - Physical Infrastructure	. 13
	5.1	Level 2 of Physical Infrastructure	. 13
	5.2	Level 2 - Physical Infrastructure/Roadway type	. 14
	5.3	Level 2 - Physical Infrastructure/ Roadway Edge	. 18
	5.4	Level 2 - Physical Infrastructure/- Roadway Geometry	. 20
	5.5	Level 2 - Physical Infrastructure/Junctions	. 21
	5.6	Level 2 - Physical Infrastructure/Temporary structures	. 23
	5.7	Level 2 - Physical Infrastructure/Fixed surrounding structures	. 24
	5.8	Level 2 - Physical Infrastructure/ Special structures and characteristics	. 25
	5.9	Level 2 - Physical Infrastructure/ Signage	. 26
6	The	ne 2 – SCENERY	. 28
	6.1	Level 2 of Scenery	. 28
	6.2	Level 2 – Scenery / Specific Zones	. 29
	6.3	Level 2 - Scenery / Region/State	. 29
	6.4	Level 2 - Scenery / Geofencing	. 30
7	The	me 3 – Environmental conditions	. 31
	7.1	Level 2 of Environmental conditions	. 31
	7.2	Level 2 - Environmental conditions /Weather conditions	. 32
	7.3	Level 2 - Environmental conditions /Particulates	. 33
	7.4	Level 2 - Environmental conditions /Weather-induced roadway conditions	. 33
	7.5	Level 2 - Environmental conditions /Illumination	. 34
	7.6	Level 2 - Environmental conditions /Ambient air temperature	. 35
	7.7	Level 2 - Environmental conditions /Humidity rate (level) in the air	. 35
8	The	ne 4 – TRAFFIC conditions	. 36
	8.1	Level 2 of Traffic conditions	. 36
	8.2	Level 2 - Traffic conditions / Traffic density	. 37
	8.3	Level 2 - Traffic conditions / Road users (type & speed)	. 38
	8.4	Level 2 - Traffic conditions / Traffic safety	. 39

9 Th	neme 5 – DIGITAL INFRASTRUCTURE	40
9.1	Level 2 of Digital infrastructure	40
9.2	Level 2 - Digital infrastructure / Information type	
9.3	Level 2 - Digital infrastructure / Connectivity	
10	Theme 6 – operational REQUIREMENTS	
10.1	Level 2 of Operational requirements	
10.2	Level 2 - Operational requirements /Transportation usage	
10.3	Level 2 - Operational requirements /Ego Speed	45
10.4	Level 2 - Operational requirements /Possible/Required maneuvers	
10.5	Level 2 - Operational requirements /Vehicle geometry (dimensions)	
10.6	Level 2 - Operational requirements /Specific technical requirements for the inf	rastructure
or o	peration	
10.7	Level 2 - Operational requirements /Response to specific road users	49
11	Conclusion	50
12	APPENDIX	50

1 INTRODUCTION

The operational design domain (ODD) defines the conditions under which a driving automation system is designed to perform the dynamic driving tasks (DDT).

Beside the automation level, the ODD description is the key point of the Automated Driving Systems (ADS) performance. The capability of ADS to safely perform the dynamic driving task is demonstrated under the particular operational conditions limited by the ODD. Where a Level 5 ADS is not supposed to have any ODD limitation, the level 3 or 4 will have ODD limitations such as speed range, environmental conditions, traffic conditions, road conditions, etc. Therefore, the ODD will have to be monitored and any ODD exit must lead to a DDT fallback.

The definition of ODD must therefore allow describing in an unambiguous manner the external world within which the ADS can perform the DDT. The way (e.g. terms, scales, quality) the ODD is described will be used widely throughout the whole ADS specification, design, validation and operation phases, making it a founding milestone of the process.

In the following text, the term "automated vehicle" refers to automated passenger transportation shuttles and to automated goods delivery vehicles, which are the target use cases of PRISSMA.

2 METHODOLOGY

2.1 Taxonomy

Defining a taxonomy of the basic terms used in the description of an ODD is a fundamental task. Indeed, the taxonomy defines operational world terms for specifying driving scenarios and their attributes. As common language, the taxonomy for the ODD definition will enable ADS manufacturers to specify and implement safety requirements in their designs, and allow users, operators and regulators to reference set of ODD attributes and performance requirements in their procurements. It will also enable ADS manufacturers, developers and suppliers of components and subcomponents to define the operating capability and assemble sets of evidence that will improve confidence in the safety of the resulting product (such as component specifications) and in the data obtained from appropriate test and verification activities. Then, the same language will also be used for the specification and configuration of the different tests and scenarios on which the evaluation process is based.

As a common language, taxonomy is the bridge that allows cohesion and relevance between all activities. By building the taxonomy adapted to the ODD description, it is thus necessary to ensure that this same taxonomy is well suited to the OD (Operational Domain) description and to the associated scenarios.

The Operational Domain (OD) describes what the world actually is. Whereas the ODD refers to the system capabilities to handle operating conditions, the OD (Operational Domain) refers to the real world, describing the real operating condition the vehicle encounters.

As a system must always operate within its capabilities, it must be proved that the operational domain is always fitted for the ODD. OD and ODD shall then use taxonomy with common structure and attributes, in order to allow easier proof.

The taxonomy must make it possible to describe the real world in a precise and unambiguous manner, and with the granularity adapted to each activity. Moreover, the structure of the taxonomy must be sufficiently open to allow its incremental improvement and enrichment.

A basic taxonomy has been defined on the basis of a state of the art for ODD taxonomy based on academic, standard, institutional and Work Group (WG) documents.

In this deliverable, we propose to present our work in developing this basic taxonomy so that it can be used for both the definition of the operational area (OD) and the definition of the operational design domain (ODD).

2.2 Reading template

Based on the results presented in Deliverable 8.9, we developed the taxonomy in group meetings. The first general idea was to propose a large enough tree structure, able to cover the different components identified in the literature and presented in L8.9. Then this components list was challenged with the different usages of taxonomy: definition of the operational area (OD), definition of the operational design domain (ODD), definition of tests and scenarios.

The choice was made to cover the different possible usages of the taxonomy. General idea has been to propose a set of components as large as needed, first for ODD description, second for OD and scenarios description. For instance, the L2 component "Roadway geometry" includes a L3 component "Length" which describe the length of the area. This L3 component will be useful for the OD description (e.g., description of the length of a roadway slice in the real world, but will not be used for the ODD to describe the conditions under which the system is designed to perform the dynamic driving tasks).

The outcome of these discussions was the general taxonomy as presented in this deliverable.

3 DESCRIPTION OF THE PROPOSED TAXONOMY

3.1 Deliverable structure

The purpose of this deliverable is to present the work on the general taxonomy as results of our work carried out in the framework of tasks 8.6/7/8.

The proposed structure for the taxonomy includes three levels : L1 to L3.

We will first present the taxonomy in the form of an overall tree structure. In a second step, we will present each subset of the above-mentioned general taxonomy in detail. Finally, for each attribute at the L3 level, we will describe the attribute and make proposals for the associated metric.

The taxonomy is also presented in the form of an excel file attached as an appendix of this deliverable



[L8.11] Definition and characterization of the ODD

8

3.2 Taxonomy – Level 1 / 2 - Tree Structure



4 DESCRIPTION OF THE ATTRIBUTES OF THE TAXONOMY

4.1 Introduction

The next paragraphs will be dedicated to the description of each elements of the taxonomy. We first describe the elements of level L1, then those of level L2 and so on until we describe all the taxonomy in detail.

4.2 Description of the different levels of the taxonomy:

Level 1

The proposed taxonomy, resulting from the work carried out within Task 8.6/7/8 of PRISSMA Project is composed of six main themes (level L1):

- Theme 1 Physical infrastructure includes all the information related to the configuration, the state and the equipment of the physical infrastructure : Roadway type, roadway surface, roadway edge, roadway geometry, junctions, temporary structures, fixed surrounding structures, special structures and characteristics, signage;
- **Theme 2 Scenery** includes all the information related to the scene, going beyond the physical infrastructure : specific zones, region/states, geo-fencing;
- Theme 3 Environmental conditions- includes all information related to weather conditions, particulates, illumination, temperature, weather-induced roadway conditions, air humidity;
- Theme 4 Traffic conditions includes all information related to traffic conditions :traffic density, road users , traffic safety;
- **Theme 5 Digital infrastructure** includes all information related to digital infrastructure and connectivity (which are necessary to safely perform the dynamic driving task): type of information, connectivity;
- Theme 6 Operational constraints includes all information related to vehicle capabilities : maximal/authorized speed, maneuvers, vehicle dimensions, etc.;

Levels L2 and L3

For each of the main themes described above, the tables presented in the remainder of this deliverable describe the set of L2 level attributes as well as the set of L3 components of the proposed taxonomy. Furthermore, in order to better describe the concrete meaning of L3 components, a list of possible values or a scale is proposed for information and illustration.

4.3 Different uses of L3 components

The tables specify the possible uses of each level L3 component, distinguishing between three cases ODD/OD/SCEN:

Case "ODD":

ODD = Conditions that allow ego vehicle to perform safely the dynamic driving tasks (system capabilities).

The L3 component can be used to describe the ODD

The attributes of ODD address the question "Which conditions may the system accept while operating safely?"

Eg "1.1.5 Usage of the ego lane = All traffic lane": the ego vehicle has the capability to drive safely on a lane with all kind of traffic. 1.1.5 attribute is not enough precise for describing an actual situation.

- Case "OD":

OD = real operating conditions that are encountered by the ego vehicle.

The L3 component can be used to describe the operational domain.

The attributes of OD address the question "Which conditions does the system encounter on its current route?"

Eg "1.1.6 Ego allowed to drive on traffic lane $n^{\circ} 3 = yes > and "1.1.7$ Use of traffic lane $n^{\circ} 3 = all traffic lane" : on its current route section, the ego vehicle drives on lane <math>n^{\circ} 3$ which is allowed for all kind of traffic.

The 1.1.6 is not enough generic for describing a system capability.

- Case "SCEN":

The L3 component can be used to describe the scenery and the environment of the different driving scenarios. The SCEN attributes answer to question, "Which conditions should we imagine the system may encounter in its operational domain?"

Eg "1.1.6 Ego allowed to drive on traffic lane $n^{\circ} 3 = yes$ » and "1.1.7 Use of traffic lane $n^{\circ} 3 =$ all traffic lane" : the driving scenarios must integrate configurations with the ego vehicle driving on the third lane with all kind of traffic.

The 1.1.6 is not enough generic for describing a system capability.

Notable items:

- a. A "traffic lane" refers to a lane where the ego vehicle could physically travel.
- b. Some L3 components describe the characteristics of traffic lanes. As it may exist several traffic lanes, the description is given for "lane number i (or j)" and the mention "Repeat i (or j) = 1 to n" is present in column "details.
 - "i" refers to all traffic lanes, i.e. ego direction traffic lanes, opposite direction traffic lanes and crossing lanes in the case of junction;
 - "j" refers to the crossing lanes in the case of junction.
- c. The "right side" and "left side" are defined with reference to the ego vehicle moving direction.

d. The "ego direction" and "the opposite direction are defined with reference to the ego vehicle moving direction.

5 THEME 1 - PHYSICAL INFRASTRUCTURE

5.1 Level 2 of Physical Infrastructure

Leve	Level 1 : 1 - PHYSICAL INFRASTRUCTURE								
N°	Level 2	Description							
1.1	Roadway type	Road layout description							
1.2	Roadway edge	Road side description							
1.3	Roadway geometry	Roadway geometrical characteristics							
1.4	Junctions	Type of junctions that may be encountered in the area /that may be supported by the vehicle							
1.5	Temporary structures	Type of temporary structures that may be encountered in the area and that can be supported by the vehicle (constructions, works, etc.), i.e. movable structures in the area which may impact the vehicle driving task							
1.6	Fixed surrounding structures	Fixed structures in the area which may impact the vehicle driv- ing task							
1.7	Special structures	Special structure in the area which may impact the vehicle driv- ing task							
1.8	Signage	Road signage that may be encountered in the area and that can be supported by the vehicle (traffic signs, traffic lights, etc.)							

5.2 Level 2 - Physical Infrastructure/Roadway type

1.1	Roadway type						
Tittle	description	Possible values or scale	Po	Possible use		Details	
			ODD OD SCE				
1.1.1 Road category	Road category based on lane	One-way roads	Х	Х	Х	General road layout	
	traffic	Two-way roads					
		Divided Roads					
		Roads with variable lane assignment					
1.1.2 Specific infrastructure configuration	Configuration of the roadway	Current traffic (not applicable)	Х	Х	Х		
		Distress lane					
		Storage lane					
		Parking					
		Toll booth					
		bridge/viaduct					
		tunnel/underpass					
		ramp					
		intersection Railroad crossing					
		tramway intersection					
1.1.3 Roadway general orientation	Geographical orientation of	Eastbound		Х	Х	The road orientation is not con-	
	the roadway	South-East bound				sidered as relevant for describ-	
		South bound				ing the ODD	
		South-West bound					
		Westbound				Possible link with "3.4.3 interfer-	
		North-West bound				ing illuminances = grazing sun in	
		Northbound				front"	
		North East bound					

1.1		Roadway type						
Tittle		description Possible values or scale		Po	ssible	use	Details	
				ODD	OD	SCEN		
1.1.4 Eventual usage type		Roadway general usage	Roads open to all traffic types Ego-only roads Car-only lanes Meeting Zones Pedestrian walkways Roads closed to motor vehicles	X	X	x	Concerns the general roadway use	
1.1.5 Ego allowed to drive on traffic lane n°i		Can the ego vehicle drive on the lane n° i ?	Yes/no		х	Х	Repeat i = 1 to n	
1.1.6 Use of lanes	1.1.6a Use of the ego lane	Ego lane(s) usage	Ego only traffic lane All traffic lane Pedestrian zone / soft modes Cycle track Bus lane	X			defines the possible uses of the lane(s) on which ego vehicle is allowed to drive	
	1.1.6b Use of the left lane 1.1.6c Use of the right	Type of lane left side of ego lane Type of lane right side of ego	All traffic lane Pedestrian zone / soft modes Cycle track Shoulder lane Bus lane	X				
	lane	lane						
	1.1.6d Use of traffic lane n° i	Type of lane i	Ego only traffic lane All traffic lane Pedestrian zone / soft modes Cycle track Shoulder lane Bus lane		X	X	Repeat i = 1 to n	

1.1		Roadway type						
Tittle		description Possible values or scale		Possible use			Details	
				ODD	OD	SCEN		
1.1.7 Traffic lanes direc- tion	1.1.7a direction of lefttraffic lane1.1.7b direction of right	Direction of the lane left side of ego lane Direction of the lane right	Ego direction Opposite direction	X X			The reference for the driving di- rection is the driving direction of ego vehicle.	
	1.1.7c direction of traffic lane n° i	Direction of the lane i	Ego direction Opposite direction No direction (e.g. lane in intersec- tion)		X	x	Repeat i = 1 to n	
1.1.8 element on the lanes not preventing traf-	1.1.8a possible element on the ego traffic lane not preventing traffic		 rutting subsidence pothole 	Х				
	1.1.8b element on the traffic lane n° i not pre- venting traffic	regularity of the traffic lane n° i due to bad condition of the road pavement, or to a specific equipment	 manhole covers fillings speed bump speed bump with sound strip chicane speed bump lock speed bump lock speed bump tight curve retarder cushion-type speed bump trapezoidal type speed bumps roadway elevation railway level crossing platform parking bumps 		x	x	Repeat i = 1 to n	

1.1	Roadway type						
Tittle	description	Possible values or scale	Ро	ssible	use	Details	
			ODD	OD	SCEN		
1.1.9 type of pavement surface	Pavement Surface type	Asphalt pavement	Х	Х	Х		
		Concrete					
		Composite pavement					
		Gravel surface					
		Pavers					
		Thin geotextile membrane					
		Unpaved					
1.1.10 Luminance of the road surface	Luminance of the roadway		Х	Х	Х		
	surface						
1.1.11 Pavement grip coefficient	Indicator of the road pave-		Х	Х	Х		
	ment grip properties						
1.1.13 Road marking contrast	Visual contrast between the		Х	Х	Х		
	road marking and the back-						
	ground						

5.3 Level 2 - Physical Infrastructure/ Roadway Edge

1.2		Roadway edge						
Tit	ttle	description	description Possible values or scale	Possible use			Details	
		C		ODD	OD	SCEN		
1.2.1 Element of Infra- structure adjacent to the lane	1.2.1a Nature of the ele- ment of infrastructure ad- jacent to ego lane on the left side	Element of Infrastructure ad- jacent to the lane where traf- fic is physically not possible (sidewalk, fence,)	sidewalk, central reservation, fence, wall, tree, angle parking, parallel parking, path, ditch, river, ravine, di- viding island,)	X				
	1.2.1b Nature of the ele- ment of infrastructure ad- jacent to ego lane on the right side	Element of Infrastructure ad- jacent to the lane where traf- fic is physically not possible (sidewalk, fence,)	sidewalk, central reservation, fence, wall, tree, angle parking, parallel parking, path, ditch, river, ravine, di- viding island,)	X				
	1.2.1c Element of Infra- structure adjacent to the lane 1 on its left side	Element of Infrastructure ad- jacent to the lane 1 where traffic is physically not possi- ble (sidewalk, fence,)	Nature (sidewalk, central reservation, fence, wall, tree, angle parking, paral- lel parking, path, ditch, river, ravine, dividing island,)		Х	X		
			position (X,Y)		Х	Х		
			Height (m)		Х	х		
			Length (m)		Х	Х		
			opaque yes/no (mask)		Х	Х		
	1.2.1d Element of Infra- structure adjacent to the lane i on its right side	Element of Infrastructure ad- jacent to the lane i where traffic is physically not possi- ble (sidewalk, fence,)	Nature (sidewalk, central reservation, fence, wall, tree, angle parking, paral- lel parking, path, ditch, river, ravine, dividing island,)		X	X	Repeat i = 1 to n	
			position (X,Y)		X	X	-	
			Height (m)		X	X	4	
			opaque yes/no (mask)		X X	X X		

1	2	Roadway edge					
Tittle		description Possible values or scale Possible use					Details
Nota	The right/left is related to the	he ego vehicle moving direction				JCEN	

5.4 Level 2 - Physical Infrastructure/- Roadway Geometry

1.3		Roadway geometry							
Т	ittle	description	Possible values or scale	Possible use			Details		
				ODD	OD	SCEN			
1.3.1 Width of the lanes	1.3.1a Minimal width of the ego lane	Minimal lane width which is necessary for ego vehicle	cm	X					
	1.3.1b Width of the lane n° i	Geometrical width of the lane n° i	[l1;l2] width classes in cm		X	X	Repeat i = 1 to n		
1.3.2 Cross slope			% or classes, up/down according to sign		Х	X			
1.3.3 Radius of curvature			m	X	Х	X	For the ODD, the at- tribute defines the minimum radius		
1.3.4 Length of the link section			m		Х	X			
1.3.5 Slope			% or classes, up/down according to sign	X	Х	X	For the ODD, the at- tribute defines the min/max values		
1.7.1 Unsuitable area for stopping the vehicle		Absence of place in the area where the ego vehicle could stop to reach a minimum risk condition.	Yes/no		X	X	At this point, the ab- sence of suitable area for MRC was not con- sidered relevant for ODD description.		

5.5 Level 2 - Physical Infrastructure/Junctions

1	4		Junctions				
Ti	ttle	description	Possible values or scale	Possible use			Details
				ODD	OD	SCEN	
1.4.1 configuration of the in	ntersection	Type of intersection	X intersection T-intersection Y-intersection star intersection single traffic round about double traffic round about triple traffic round about Left turn Merging lane merging of lanes roundabout railway level crossing platform Tramway lane intersection	X	X	X	
1.4.2 Number of branches	of the intersection branch				Х	Х	
1.4.3 Angle of the cross- ing lanes	1.4.3a Maximal angle be- tween ego lane and inter- section branch		-180/+180	x			The angle reference is the ego lane direction
	1.4.3b Angle of lane n° j	Angle between ego lane and lane n°j	-180/+180		X	X	The angle reference is the ego lane direction Repeat j = 1 to n

1.4.4 Priority rules	Priority rule applicable for the ego vehicle lane	Right priority lane priority roundabout traffic lights flashing light R24 light YIELD STOP Tramway line priority	X	X	X	Hypothesis is made that the same rules apply to each lane where the ego vehicle can possibly drive
1.4.5 particularity of the intersection Nota Describes the type of to The kind of temporary	Any eventual particularity of the intersection, e.g. specific layout, specific priority rule mporary structures in the area/that o tructure will have to be completed.	e.g. Expanded bicycle line	X ions, woi	X rks, etc.	x)	

[L8.11] Definition and characterization of the ODD

5.6 Level 2 - Physical Infrastructure/Temporary structures

1.5	Temporary structures					
Tittle	description Possible values or scale Possible use Det				Details	
			ODD	OD	SCEN	
1.5.1 Workzone		Yes/no	Х	Х	Х	
Nota	Describes the type of temporary structures in the area/that can be supported by the vehicle (constructions, works, etc.)					
	The kind of temporary structure	will have to be completed.				

5.7 Level 2 - Physical Infrastructure/Fixed surrounding structures

1.6		Fixed surrounding struc	tures			
Tittle	description	Possible values or scale	F	ossible	use	Details
			ODD	OD	SCEN	
1.6.1 constraints on masks from the visibil- ity point of view	Any fixed structure that creates a visual mask for the ego vehicle			х	x	It seems difficult to describe trough the ODD attributes all the visual mask types a vehicle
.,						may encounter
1.6.2 constraints on masks from the geo- positioning point of view	Any fixed structure that could cre- ate a mask for the geo-positioning system of the ego vehicle	tunnel trench parking/garage toll booth urban canyon multiple reflections dense vegetation cover GPS/GNSS disturbance zone	x	X	X	
1.6.3 constraints on masks from the con- nectivity point of view	Any fixed structure that could cre- ate a mask for the connectivity sys- tem of the ego vehicle	vegetated area tunnel trench metal structure parking/garage toll booth urban canyon multiple reflections radio interference zone	x	X	X	
Nota	The "physical infrastructure" attribut advertising, etc.)	es concern the type of surrounding structures	in the area	a/that m	ay affect th	ne vehicle (buildings, vegetation,

5.8 Level 2 - Physical Infrastructure/ Special structures and characteristics

1.7	Special structures							
Tittle	description	Possible values or scale		Possible use		Possible use		Details
			ODD	OD	SCEN			
1.7.1 Crossing of vul-	Unsuitable area for stopping	Crosswalk yes/no		Х	Х	Different crossing can be find		
nerable users	the vehicle			V	V	In the same area		
		Bicycle crossing yes/no		X	×			
		shared zone crossing yes/no		Х	Х			
1.7.2 Marking of cycle	Circulation of cycles along the	Yes/no	Х	Х	Х			
zone on the ego lane	ego lane with specific marking							
Nota	Describes any punctual structure	or characteristic in the area/that may impact the v	ehicle be	havior (p	edestrian d	crossing, shared zone, unsuitable		
	area for stopping).							

5.9 Level 2 - Physical Infrastructure/ Signage

1.8	Signage						
Tittle	description	Possible values or	Pos	sible use	9	Details	
		scale	ODD	OD	SCEN		
1.8.1 vertical traffic signs	type A : hazard		Х	Х	Х	Cf IISR part 1	
	type AB : priorities at intersection		Х	Х	Х		
	Type B prescriptions		Х	Х	Х		
	Type C useful indications		Х	Х	Х		
	Type CE useful services indication		Х	Х	Х		
	Type D signalization and positioning		Х	Х	Х		
	Type E entries/end of urban zones		х	Х	Х		
	Type G Railway crossing localization		Х	Х	Х		
	Type SR information for road safety		Х	Х	Х		
1.8.2 traffic lights	Type R / type KR		x	Х	Х	Cf IISR part 6	
1.8.3 road markings (horizontal markings)	Туре Т		X	Х	Х	Cf IISR part 7	
1.8.4 guidance equipment	Туре Ј		Х	Х	Х		
1.8.5 boundary markers			Х	Х	Х	Cf IISR part 1	
1.8.6 closing devices			X	Х	Х	Cf IISR part 1	
1.8.7 dynamic signs	Туре Х		X	Х	Х	Cf IISR part 9	
1.8.9 temporary signs	Type AK Hazard		Х	Х	Х	Cf IISR part 8	
	Type K Specific		Х	Х	Х		
	Type KC workzones		Х	Х	Х		
	Type KD Lane merging		X	Х	Х		

1.8		Signage				
Tittle	description	Possible values or	Poss	ible use	:	Details
		scale	ODD	OD	SCEN	
1.8.10 connected equipment	Refers to the "V2I" communication ca- pability of the vehicle (ODD) and to the V2I connectivity of the infrastructure (OD).	Type of equipment	х	X	X	
Nota	Describes the type of signage present in the au The signage rules according to French regulat The proposed categories refers to the "INSTRU SUR LA SIGNALISATION ROUTIÈRE" (IISR) docu	Describes the type of signage present in the area (traffic signs, traffic lights, etc.), and which are applicable to the ego vehicle circulation. The signage rules according to French regulation were taken as reference for the road signage. The proposed categories refers to the "INSTRUCTION INTERMINISTÉRIELLE SUR LA SIGNALISATION ROUTIÈRE" (IISR) document that define the different authorized signs, marks and equipment, for France.				

6 THEME 2 – SCENERY

6.1 Level 2 of Scenery

Leve	Level 1: 2 - SCENERY					
N°	Level 2	Description				
2.1	Specific zones	Corresponds to areas that may have specific speed or mobility restrictions (school, hospital, etc.), or that may lead to specific behaviors and scenarios				
2.2	Region/State	Corresponds to constraints that may be related to the re- gion/department/state in which the vehicle is travelling (speed, traffic lane, etc.)				
2.3	Geofencing	Corresponds to a limitation of the areas in which the travel of ego vehicle is allowed				

6.2 Level 2 – Scenery / Specific Zones

2.1		Specific zones				
Tittle	description	Possible values or scale	Possible use		se	Details
			ODD	OD	SCEN	
Specific zones	areas that may have specific	school,		Х	х	At this point, the specific
	speed or mobility restrictions	retirement home				zones were not considered
	(school, hospital, etc.), or that	hospital				relevant for the ODD descrip-
	may lead to specific behaviors	stadium exit > X people				tion.
	and scenarios	exit from a theater > X people				
		shopping center exit				
		animal crossing				
		fire station				
		etc				
Nota	Describes to areas that may have	specific speed or mobility restrictions (school, hosp	ital, etc.), o	or that m	nay lead t	o specific behaviors and scenar-
	ios.					

6.3 Level 2 - Scenery / Region/State

2.2	Region /State									
Tittle	description	Possible values or scale	Possible use		Possible use		Possible use		se	Details
			ODD	OD	SCEN					
Region /state	constraints that may be related	Country	Х	Х	Х					
	to the region/department/state	Geographic area								
	in which the vehicle is travelling									
	(speed, traffic lane, etc.)									
Nota	Describes the constraints that ma	y be related to the region/department/state in whi	ich the veh	icle is tra	velling (s	peed, traffic lane, etc.)				

6.4 Level 2 - Scenery / Geofencing

2.3	GEOFENCING					
Tittle	description	Possible values or scale	Ро	Possible use Details		Details
			ODD	OD	SCEN	
Geofencing	limitation of the areas in which the travel of ego vehicle is allowed		X			Geofencing functionality is seen only as an ego vehicle capability, which allows the ego vehicle to be restricted to a specific area.
Nota	describes the potential limitation of the a	reas in which the travel of the ego vehicle	is allowed			

7 THEME 3 – ENVIRONMENTAL CONDITIONS

7.1 Level 2 of Environmental conditions

Leve	Level 1 : 3 - ENVIRONMENTAL CONDITIONS							
N°	Level 2	Description						
3.1	Weather conditions	type of weather (precipitation level) that may be en- countered in an area/supported by the vehicle (rain, snow, etc.)						
3.2	Particulates	type of particulates that may be encountered in an area/supported by the vehicle (smoke, fog, sand, etc.)						
3.3	Weather-induced roadway conditions	Roadway conditions that may be experienced in an area/supported by the vehicle (slippery road - rain, ice, snow -, snowy road, submerged road, etc.)						
3.4	Illumination							
3.5	Ambient air temperature	temperature range that may be experienced in an area/supported by the vehicle						
3.6	Humidity rate(level) in the air							

3.1	Weather Conditions						
Tittle	description	Possible values or scale	Po	ssible	use	Details	
			ODD	OD	SCEN		
3.1.1 Rain		Drop size, rain intensity mm/h, opacity level,	Х		Х	The proposed scales have to be	
		speed (m/s), direction				refined	
3.1.2 Snow		Size (µm)	Х		Х		
		Visibility (m)					
		Speed (m/s)					
		Direction					
3.1.3 Hail		Size (µm)	Х		Х		
		Visibility (m)					
		Speed (m/s)					
3.1.4 Fog		Size (µm) X X					
		Visibility (m)					
		Speed (m/s)					
3.1.5 Wind		Speed (km/h), speed gradient, direction X X]	
Nota	Describes the type of weather (pl	recipitation level) in an area/supported by the vehicl	le (rain, s	now, et	tc.)	•	

7.2 Level 2 - Environmental conditions /Weather conditions

7.3 Level 2 - Environmental conditions /Particulates

3.2	Particulates						
Tittle	description	Possible values or scale	Po	Possible use		Details	
			OD	OD	SCEN		
			D				
Particulates	Kind of particulates present	smoke			Х	At this point, the particulates were	
	in the air and that may af-	sand				not considered relevant for the	
	fect the vehicle capabilities	es dust ODD description.				ODD description.	
		wind-blown debris					
Nota	Describes the type of particulates that may be encountered in an area/supported by the vehicle (smoke, fog, sand, etc.)						

7.4 Level 2 - Environmental conditions /Weather-induced roadway conditions

3.3		Weather-induced roadway conditions				
Tittle	description	description Possible values or scale Possible use		Details		
			ODD	OD	SCEN	
Weather-induced road-	State of the road surface due to	normal	Х		Х	
way conditions	the weather conditions	wet				
		puddles, accumulations				
		flooded				
		snowy				
		muddy				
		icy				
Nota	Describes the roadway conditions	Describes the roadway conditions that may be experienced in an area/supported by the vehicle (slippery road - rain, ice, snow -)				

3.4	Illumination					
Tittle	description	Possible values or scale	P	ossible u	se	Details
			ODD	OD	SCEN	
3.4.1 Illumination level	Level of the illumination	Lux	Х		x	
3.4.2 illumination condi- tions	Type of the illumination	day night dawn/dusk natural light artificial light fog night with public lighting night without lighting	x		X	
3.4.3 interfering illumi- nances	Any specific lighting conditions that may occasionally modify the illumination	Not applicable Passing vehicle headlights Headlights of the following vehicles Position lights of other vehicles in lane Grazing sun in front Reflections			X	The attribute describes a tran- sient situation that has to be taken into account through the scenarios, but that can not be described when de- scribing the real route
3.4.4 Illuminance variation	Gradient of illumination that can occur	Not applicable gradient of variation		х	X	It can be the case when the ego vehicle enters or exit a tunnel

7.5 Level 2 - Environmental conditions /Illumination

7.6 Level 2 - Environmental conditions /Ambient air temperature

3.5	Ambient and air temperature							
Tittle	description	Possible values or scale	Possible use		Possible use Details			
			ODD OD SCEN					
Minimum/Maximum ambient air	°C X X V			Vehicle's and equipment's				
temperature	temperature range							
Nota	Describes the temperature range that may be experienced in an area/supported by the vehicle							

7.7 Level 2 - Environmental conditions /Humidity rate (level) in the air

3.6	Humidity rate (level) in the air					
Tittle	description	Possible values or scale	Possible use			Details
			ODD	OD	SCEN	
Maximum humidity rate in the air		%	X X			Maximal humidity value for
						vehicle and equipment

8 THEME 4 – TRAFFIC CONDITIONS

8.1 Level 2 of Traffic conditions

Leve	Level1 : 4-TRAFFIC CONDITIONS						
N°	Level 2	Description					
4.1	Traffic Density	Level of traffic possibly encountered on the road					
4.2	Road Users (Speed & type)	Type and speed of the other road users					
4.3	Traffic Safety	Any specific behavior of road users that may impact					
		the safety					

8.2 Level 2 - Traffic conditions / Traffic density

4.1	Traffic density					
Tittle	description	Possible values or scale	Ро	ssible	use	Details
			ODD	OD	SCEN	
4.1.1 Traffic density on	Level of traffic possibly en-	Low/Middle/High	Х			
the ego direction traffic	countered on the lane					
lane(s)						
4.1.2 Traffic density on			Х			
the opposite direction						
traffic lane(s)						
4.1.3 Traffic density on			Х			(if junction)
the crossing traffic lane(s)						
4.1.4 Traffic density on				Х	Х	Repeat i = 1 to n
the traffic lane n° i						

8.3 Level 2 - Traffic conditions / Road users (type & speed)

	4.2		Road users type & spe	eed			
Т	ittle	description Possible values or scale		Po	ssible	use	Details
				ODD	OD	SCEN	
4.2.1 Road users type	4.2.1a Road users type on the ego direction traffic lane(s)	type of possibly encountered other road users on traffic lane	pedestrian, bicycle, 2 Wheel Drive, Light vehicles	X			
	4.2.1b Road users type on the opposite direction traffic lane(s)		Heavy vehicles	X			
	4.2.1c Road users type on the crossing traffic lane(s)			X			(if junction)
	4.2.1d Road users type on the traffic lane n° i				X	X	Repeat i = 1 to n
4.2.2 Road users speed	4.2.2a Road users speed on the ego direction traf- fic lane(s)	speed of possibly encoun- tered other road users, on the traffic lane	speed classes for each type	X			
	4.2.2b Road users speed on the opposite direction traffic lane(s)			X			

4.2		Road users type & speed						
Tittle	2	description Possible values or scale		Possible use			Details	
				ODD	OD	SCEN		
4. or la	.2.2c Road users speed n the crossing traffic ane(s)			X			(if junction)	
4. or	.2.2d Road users speed n the traffic lane n° i				X	X	Repeat i = 1 to n	

8.4 Level 2 - Traffic conditions / Traffic safety

4.3	Traffic Safety						
Tittle	description	Possible values or scale	P	ossible u	ise	Details	
			ODD	OD	SCEN		
4.3.1 Risky behavior of third parties	Third party behavior that may affect the safety and that may be locally noted	Speed limits not respected Priority not respected 		Х	Х		
4.3.2 Particularly accident- prone areas	Any local area with a high number of traffic accidents	Yes/no		X	X	This attribute allows to tag some particular actual config- uration, in order to analyze it specifically e.g.	

9 THEME 5 – DIGITAL INFRASTRUCTURE

9.1 Level 2 of Digital infrastructure

Leve	Level 1: 5-DIGITAL INFRASTRUCTURE						
N°	Level 2	Description					
5.1	Information type	Type of information expected or provided through connectivity					
5.2	Connectivity	Category and technology of the connectivity					

9.2 Level 2 - Digital infrasti	ucture / Information type
--------------------------------	---------------------------

5.1	Information type					
Tittle	description	Possible values or scale	Po	ossible u	se	Details
			ODD	OD	SCEN	
5.1.1 GPS signal	Position data needed	Signal type	Х	Х		
5.1.2 Radio landmark for geo posi- tioning recalibration	Local reference position given through a connectivity link	Type of landmark expected	Х	Х		
5.1.3 information expected by the	Any real time data needed by	temperature	Х	Х		
vehicle	the vehicle	Traffic conditions	Х	Х		
		Accident	Х	Х		
		Priority vehicles approaching	Х	Х		
		Traffic light status	Х	Х		
		Weather conditions	Х	Х		
		Mobile equipment position	Х	Х		
			Х	Х		
5.1.4 information expected by the system	Any data needed by the system	For instance : HD map	x	x		The "system" means all de- vices and equipment dedi- cated to the vehicle of the ego, with the exception of those integrated
Nota	This set of information defines the ODD in the way that these information have to be available in order the ego vehicle can perform safely the dynamic driving tasks.					

9.3 Level 2 - Digital infrastructure / Connectivity

5.2	Connectivity							
Tittle	description	Possible values or	Р	ossible u	se	Details		
		scale	ODD	OD	SCEN			
5.2.1 V2V	Connectivity link between ego vehicle and other vehicles	5G, ITS-5G, C-V2X,	X	Х		If relevant		
5.2.2 V2FLEET	Connectivity link between ego vehicle and the other vehi- cles of the fleet	5G, ITS-5G, C-V2X,	x	х		If relevant		
5.2.3 V2PCC	Connectivity link between ego vehicle and the remote con- trol center	5G, ITS-5G, C-V2X,	x	х		If relevant		
5.2.4 V2SEN	Connectivity link between ego vehicle and sensors located on the road	5G, ITS-5G, C-V2X,	х	х		If relevant		
5.2.5 V2DEV	Connectivity link between ego vehicle and devices (traffic lights, mobile barrier, dynamic signs,)	5G, ITS-5G, C-V2X,	x	Х		If relevant		
5.2.6 V2P	Connectivity link between ego vehicle and emergency vehicles	5G, ITS-5G, C-V2X,	х	х		If relevant		
5.2.7 V2FO	Connectivity link between ego vehicle and law enforce- ment	5G, ITS-5G, C-V2X,	X	Х		If relevant		
Nota	The categories and the technologies necessary to connect the vehicle and the system defines the ODD in the way that these connectivity links must be available in order the ego vehicle can perform safely the dynamic driving tasks.							

10 THEME 6 – OPERATIONAL REQUIREMENTS

10.1 Level 2 of Operational requirements

Level 1 : 6-OPERATIONAL REQUIREMENTS							
N°	Level 2	Description					
6.1	Transportation usage	Transport general system type					
6.2	Speed range	Ego vehicle speed range					
6.3	Possible/required maneuvers	Ego vehicle maneuvers capabilities					
6.4	Vehicle geometry (dimensions)	Ego vehicle					
6.5	Specific technical requirements on	Any specific equipment needed					
	the infrastructure or operation						
6.6	Response to the specific road-us-	Ego vehicle capabilities for interacting with					
	ers	specific road users					

10.2 Level 2 - Operational requirements /Transportation usage

6.1	Transportation usage					
Tittle	description	Possible values or scale	Possible use		se	Details
			ODD	OD	SCEN	
6.1.1 Type of transport	Persons or goods	People	Х		Х	
		Goods				
6.1.2 transport capacity		Number of persons	Х		Х	
		Weight				
		Volume m ³				
6.1.3 type of management	Organization of the trans-	Public and Shared Transportation	Х			
	portation system	Private collective transportation				
		Individual Private Transport				
		Car-sharing transportation				
Nota	The "transportation usage" defines the ODD in the way that the general characteristics of the transportation system have to be veri-					
	fied.					

10.3 Level 2 - Operational requirements /Ego Speed

6.2	Speed range						
Tittle	description	Possible values or scale	Possible use			Details	
			ODD	OD	SCEN		
Ego speed	Maximum speed (s) of ego vehicle	Km/h	Х	Х	Х	The maximum speed can vary depending on the road cate- gory, the conditions,	
Nota	The "ego speed" defines the ODD because it defines a limit for the safe behavior of the ego vehicle. It may also limit the speed of other vehicles which may interact with ego.						

6.3	Possible/Required maneuvers						
Tittle	description	Possible values or scale	Po	ossible u	ise	Details	
			ODD	OD	SCEN		
6.3.1 Maneuvers type	Maneuvers the ego vehicle can	straight ahead	Х	Х	Х	Several choices are possible	
	perform	straight ahead reverse					
		Ramp insertion					
		Turning on the road					
		Lane change left					
		Lane change right					
		Turn left					
		Turn right					
		Overtaking					
		Herringbone parking maneuver					
		In-line parking maneuver					
		Station stop					
6.3.2 Condition of achieve-	Eventual conditions required to	- minimum length	Х			Several conditions can exist	
ment (for each maneuver)	perform a maneuver	- minimum track width				for each type of maneuver	
		- maximum angle					
		- maximum slope					
		etc					
Nota	The maneuvers define the ODD bec	ause they define limits for the safe behav	vior of the eg	o vehicle.			

10.5 Level 2 - Operational requirements /Vehicle geometry (dimensions)

6.4	Vehicle geometry (dimensions)						
Tittle	description	Possible values or scale	P	ossible u	Ise	Details	
			ODD	OD	SCEN		
6.4.1 turning radius		m	Х	Х	Х	For the ODD, the attribute de-	
						fines the min value	
6.4.2 height		cm	Х	Х	Х	For the OD, the attribute de-	
						fines the max admitted value	
6.4.3 width		cm	Х	Х	Х	For the OD, the attribute de-	
						fines the max admitted value	
6.4.4 length		cm	Х	Х	Х	For the OD, the attribute de-	
						fines the max admitted value	
Nota	The "vehicle geometry" defines the ODD in	n the way that the general cha	racteristi	cs of the t	transporte	ation system have to be verified.	

10.6 Level 2 - Operational requirements /Specific technical requirements for the infrastructure or operation

6.5	Specific technical requirements on the infrastructure or operation						
Tittle	description	Possible values or scale	or scale Possible use Details				
			ODD	OD	SCEN		
6.5.1 Specific requirements for in-	Any specific need related to the system	landmark for geoposition-	Х	Х			
frastructure	infrastructure	ing, specific signs, specific					
		road marking,					
6.5.2 Specific requirements for op-	Any specific need related to the system		Х	х			
eration	operation						
Nota	The "Specific technical requirements on the infrastructure or operation" define the ODD because they define limits for the safe be-						
	havior of the ego vehicle.						

10.7 Level 2 - Operational requirements /Response to specific road users

	6.6	Response to specific road users						
Tittle		description	Possible values or scale	Po	ossible (use	Details	
				ODD	OD	SCEN		
6.6.1 Emergency vehicles	6.6.1а Туре	Type of emergency vehicles the ego vehicle can interact with	Emergency, police, firetrucks, road safety vehicles,	х		Х		
	6.6.1b Injunction nature	Nature of the injunctions perceived by ego		Х		X		
	6.6.1c Equipment	Eventual specific equipment needed for the emergency vehicle		Х		X		
6.6.2 Agents	6.6.2а Туре	Type of agents the ego vehicle can interact with	road safety officers, law en- forcement agents, road maintenance workers, emer- gency service personnel, road inspectors,	x		X		
	6.6.2b Injunction nature	Nature of the injunctions perceived by ego		х		Х		
	6.6.2c Equipment	Eventual specific equipment needed for the agents		Х		X		
	Nota	The "Specific road users requirements on the infrastructure or operation" define the ODD because the capability to interact with the specific road-users, defines limits for the safe behavior of the ego vehicle.						

11 CONCLUSION

This deliverable allowed us to go into detail in the description of the different components of the taxonomy and to identify their use for the ODD, the OD and the scenarios. The next step of the project is to define from this taxonomy, the OD, ODD and implement the validation scenarios on several POC.

12 APPENDIX

Cf the document « Taxonomie_PRISSMA_V1.xlsx »